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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/811,069	03/26/2004	Bruce Douglas Smith	UTSJ:045US	8075

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EXAMINER	
BOOSALIS, FANI POLYZOS	
ART UNIT	**PAPER NUMBER**
2884	

DATE MAILED: 07/11/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/811,069	SMITH, BRUCE DOUGLAS	
	Examiner	Art Unit	
	Faye Boosalis	2884	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 April 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-39* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-39* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Comment on Submissions

1. This communication is responsive to submission of 10 April 2006.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-5, 7-11, 15-19, 21-22, 25-28, 30-33 and 36-39 are rejected under 35 U.S.C. 102(b) as being anticipated by *Cree and Bones, "Towards Direct Reconstruction from a Gamma Camera based on Compton Scattering").*

Regarding claim 1, Cree discloses a method, comprising: determining an apex of a cone from a trajectory of a photon emitted from an object to a point of intersection on a first detector Fig. 1b and page 399, paragraph 1; determining an axis of symmetry of the cone from the point of intersection on the first detector an a point of intersection on a second detector (Fig. 2 and page 399, paragraph 1); using a finite set of integrals dependent on the apex (x_1) of the cone, the half angle (θ) of the cone, and the axis of symmetry of the cone to satisfy a completeness condition (Fig. 1b and page 399, paragraph 2); and using the finite set of integrals for image reconstruction.

Regarding claim 2, Cree discloses the apex (x_1) of the cone comprising the point of intersection on the first detector (See Fig. 1b).

Regarding claims 3-4, Cree discloses the axis of symmetry comprising determining a scatter angle (i.e. semi angle (θ), from 0 to 180 degrees, of the photon from the first detector onto the second detector (see Fig. 1b and page 399, paragraph 2).

Regarding claim 5, Cree discloses the half-angle of the cone comprising: the scatter angle of the photon (See Fig. 1b and figure (b) description).

Regarding claim 7, Cree discloses the finite set of integrals of the cone comprising computing surface integrals of the cone (See Abstract and page. 400, Section III. Cone Surface Projection, paragraph 2).

Regarding claim 8, Cree discloses the finite set of integrals of the cone comprising computing integrated line integrals (i.e. linear interpolation) of the cone (Section III. Cone Surface Projection, paragraph 1 and page 403 and paragraph 1 and page 400).

Regarding claim 9, Cree discloses the image reconstruction comprising implementing a two-step reconstruction method (page 407, Conclusion).

Regarding claims 10-11, Cree discloses, the image reconstruction comprising a method wherein the object is a patient (page 398, Introduction).

Regarding claim 15, Cree discloses a method for image reconstruction, comprising: calculating a set of conical integrals to satisfy a completion condition; and relating the set of conical integrals to a distribution of radioactivity (See Abstract and Fig. 1b and page 399, paragraph 2).

Regarding claim 16, Cree discloses the method further comprising from a trajectory of a photon from an object through a first detector and a second detector (See Fig. 1b and figure (b) description).

Regarding claim 17, Cree discloses the step of defining a cone comprising determining an apex, an axis of symmetry, and a half-angle of the cone (Fig. 1b and page 399, paragraph 2).

Regarding claim 18, Cree discloses the set of conical integrals comprising surface integrals (See Abstract and page. 400, Section III. Cone Surface Projection, paragraph 2).

Regarding claim 19, Cree discloses the set of conical integrals comprising integrated line integrals (i.e. linear interpolation) (Section III. Cone Surface Projection, paragraph 1 and page 403 and paragraph 1 and page 400).

Regarding claim 21, Cree discloses the method of reconstructing an image (page 400, paragraph 1).

Regarding claim 22, Cree discloses the image reconstruction comprising implementing a two-step reconstruction method (page 407, Conclusion).

Regarding claim 25, Cree discloses a method for image reconstruction, comprising: calculating a set of integrated line integrals to satisfy a completeness condition; and relating the set of integrated line integrals to a distribution of radioactivity (See Abstract and page. 400, Section III. Cone Surface Projection, paragraph 2).

Regarding claim 26, Cree discloses a method for image reconstruction, comprising: calculating a set of surface integrals to satisfy a completeness

condition; and relating the surface integrals to a distribution of radioactivity (See Abstract and page. 400, Section III. Cone Surface Projection, paragraph 2).

Regarding claim 27, Cree discloses a computer readable medium comprising instructions for: calculating a set of conical integrals to satisfy a completeness condition; and relating the set of conical integrals to a distribution of radioactivity (page 398, Abstract, page 402, V. Results of Computer Simulation, and page 407, VII. Conclusion).

Regarding claim 28, Cree discloses the computer readable medium comprising instructions for determining an apex and an axis of symmetry of a cone (page 402, V. Results of Computer Simulation and paragraph 1 and 2).

Regarding claim 30, Cree discloses the set of conical integrals comprising surface integrals (See Abstract and page. 400, Section III. Cone Surface Projection, paragraph 2).

Regarding claim 31, Cree discloses the set of conical integrals comprising integrated line integrals (i.e. linear interpolation) (Section III. Cone Surface Projection, paragraph 1 and page 403 and paragraph 1 and page 400).

Regarding claim 32, Cree discloses the computer readable medium comprising instructions for implementing a two-step image reconstruction (page 407, VII. Conclusion).

Regarding claim 33, Cree discloses a system, comprising: a Compton camera; at least two detectors coupled to the camera, the at least two detectors configured to obtain conical data to satisfy a completeness condition (See Fig. 1(a)(b), figure descriptions and page 399, paragraph 2).

Regarding claim 36, Cree discloses the system comprising at least two planar detectors (page 406, paragraph 1).

Regarding claim 37, Cree discloses the system comprising at least two planar detectors and a spherical-shaped detector (page 406, paragraph 1).

Regarding claim 38, Cree discloses the system comprising at least two detectors; a cylindrical detector and a spherical-shaped detector (page 406, paragraph 1).

Regarding claim 39, Cree discloses the system comprising at least two spherical-shaped detector (page 406, paragraph 1).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Cree and Bones, "Towards Direct Reconstruction from a Gamma Camera based on Compton Scattering")* as applied to claim 1 above, and further in view of in view of *Tam et al (US 6,330,298 B1).*

Regarding claim 6, Cree discloses a method, comprising: determining an apex of a cone from a trajectory of a photon emitted from an object to a point of intersection on a first detector Fig. 1b and page 399, paragraph 1; determining an axis of symmetry of the cone from the point of intersection on the first detector an

a point of intersection on a second detector (Fig. 2 and page 399, paragraph 1); using a finite set of integrals dependent on the apex (x_1) of the cone, the half angle (θ) of the cone, and the axis of symmetry of the cone to satisfy a completeness condition (Fig. 1b and page 399, paragraph 2); using the finite set of integrals for image reconstruction and a modifying filtering at high frequencies to obtain reliable reconstruction (page 404). Cree does not specifically disclose Hilbert transforms on partial derivatives of a three-dimensional Radon transform. Tam discloses a method of image reconstruction comprising: a Hilbert transform on partial derivatives of a three-dimensional Radon transform (col. 9, lines 38-67 and col. 11, lines 6-8). Tam teaches using a 1D Hilbert transform simplifies the process used to develop correction images and is well known to those skilled in CT image reconstruction technology. The filtering process incorporating the correction can be simplified by using a small number of 1D Hilbert transforms (col. 9, lines 38-67 and col. 11, lines 6-8). Therefore, it would have been obvious to modify the method disclosed by Cree to include Hilbert transforms, as disclosed by Tam, to allow for a more effective means of image reconstruction.

6. Claims 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Cree and Bones, "Towards Direct Reconstruction from a Gamma Camera based on Compton Scattering")* in view of *Weinberg et al (US 6,628,984 B2).*

Regarding claims 12-14, Cree discloses a method of image reconstruction of an object, wherein the object is a patient (page 398, Introduction). Cree does not specifically disclose of the object comprising a nuclear facility or waste site or missiles. Weinberg discloses of an image reconstruction method wherein the

object comprising radioactive waste (i.e. nuclear facility, missile or nuclear waste site (col. 11, lines 66-67 and col. 12, lines 1-6). Weinberg teaches position-integrating technology is in the surveillance of radioactive waste. There is a need for a method to describe the distribution (in three dimensions) of radioactive materials generated by, for example, a nuclear power station. These materials are occasionally buried underground as nuclear waste (col. 11, lines 66-67 and col. 12, lines 1-6). Therefore, it would have been obvious to modify the method suggested by Gullberg, to include the objects of radioactive waste, as disclosed supra by Weinberg, to allow for a more versatile method of image reconstruction.

7. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Cree and Bones, "Towards Direct Reconstruction from a Gamma Camera based on Compton Scattering")* as applied to claim 15 above, and further in view of in view of *Tam et al (US 6,330,298 B1).*

Regarding claim 20, Cree discloses a method, comprising: determining an apex of a cone from a trajectory of a photon emitted from an object to a point of intersection on a first detector Fig. 1b and page 399, paragraph 1; determining an axis of symmetry of the cone from the point of intersection on the first detector an a point of intersection on a second detector (Fig. 2 and page 399, paragraph 1); using a finite set of integrals dependent on the apex (x_1) of the cone, the half angle (θ) of the cone, and the axis of symmetry of the cone to satisfy a completeness condition (Fig. 1b and page 399, paragraph 2); using the finite set of integrals for image reconstruction and a modifying filtering at high frequencies to obtain reliable reconstruction (page 404). Cree does not specifically disclose

Hilbert transforms on partial derivatives of a three-dimensional Radon transform. Tam discloses a method of image reconstruction comprising: a Hilbert transform on partial derivatives of a three-dimensional Radon transform (col. 9, lines 38-67 and col. 11, lines 6-8). Tam teaches using a 1D Hilbert transform simplifies the process used to develop correction images and is well known to those skilled in CT image reconstruction technology. The filtering process incorporating the correction can be simplified by using a small number of 1D Hilbert transforms (col. 9, lines 38-67 and col. 11, lines 6-8). Therefore, it would have been obvious to modify the method disclosed by Cree to include Hilbert transforms, as disclosed by Tam, to allow for a more effective means of image reconstruction.

8. Claims 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Cree et al and Bones et al, "Towards Direct Reconstruction from a Gamma Camera based on Compton Scattering)* as applied to claim 21 above, and further in view of *Parra et al, "Reconstruction of cone-beam projections from Compton scattered data")*

Regarding claims 23-24, Cree discloses the method of reconstructing an image (page 400, paragraph 1). Cree does not disclose of the step of reconstructing comprising an ART-like or a SIRT-like reconstruction method. Parra discloses the step of reconstructing comprising an ART-like or an ML-EM reconstruction method (page 1543, Section I. Introduction, paragraph 2). Parra teaches various approaches have been proposed to compute the generating 3D source distribution from a collection of scattered Compton events. A series of reconstruction methods mainly concerned with numerical methods like ML, EM,

ART, etc (page 1543, Section I. Introduction, paragraph 2). Therefore, it would have been obvious to modify the method of image reconstruction, as disclosed supra by Cree, to include various reconstruction methods, as disclosed supra by Parra, to allow for a more versatile means of reconstructing images.

9. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Cree and Bones, "Towards Direct Reconstruction from a Gamma Camera based on Compton Scattering")* as applied to claim 27 above, and further in view of in view of *Tam et al (US 6,330,298 B1).*

Regarding claim 29 Cree discloses a computer readable medium comprising instructions for: calculating a set of conical integrals to satisfy a completeness condition; and relating the set of conical integrals to a distribution of radioactivity (page 398, Abstract, page 402, V. Results of Computer Simulation, and page 407, VII. Conclusion) and a modifying filtering at high frequencies to obtain reliable reconstruction (page 404). Cree does not specifically disclose Hilbert transforms on partial derivatives of a three-dimensional Radon transform. Tam discloses a method of image reconstruction comprising: a Hilbert transform on partial derivatives of a three-dimensional Radon transform (col. 9, lines 38-67 and col. 11, lines 6-8). Tam teaches using a 1D Hilbert transform simplifies the process used to develop correction images and is well known to those skilled in CT image reconstruction technology. The filtering process incorporating the correction can be simplified by using a small number of 1D Hilbert transforms (col. 9, lines 38-67 and col. 11, lines 6-8). Therefore, it would have been obvious to modify the method disclosed by Cree to

include Hilbert transforms, as disclosed by Tam, to allow for a more effective means of image reconstruction.

10. Claims 34-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Cree and Bones, "Towards Direct Reconstruction from a Gamma Camera based on Compton Scattering")* as applied to claim 33 above, and further in view of in view of *Basko et al (US 5,861,627 A).*

Regarding claims 34-35, Cree discloses a system, comprising: a Compton camera; at least two detectors coupled to the camera, the at least two detectors configured to obtain conical data to satisfy a completeness condition (See Fig. 1(a)(b), figure descriptions and page 399, paragraph 2). Cree does not disclose of the movement of the Compton camera. Basko discloses the image reconstruction system comprising a Compton camera (14) configured to move along a cine-on-cylinder curve along a circular path (i.e. gantry) (See Fig. 1, Abstract and col. 3, lines 33-36). Basko teaches the system comprising a rotatable portion of the gantry and the camera, around the subject, such that selected views can be imaged by the camera (col. 3, lines 33-36). Therefore, it is well known and obvious to modify the system disclosed by Cree to disclose movable camera along a circular path, as disclosed supra by Basko, to allow for a more efficient means of image reconstruction by the camera.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Faye Boosalis whose telephone number is 571-272-2447. The examiner can normally be reached on Monday thru Friday from 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dave Porta can be reached on 571-272-2444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

13. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

FB

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PRIMARY EXAMINER